Installation and Operating Manual

for

TOST Aircraft Wheels

Type	Technical specification	Series	Serial number
Landing wheel	**32.240/ TS**		
Shoe brake wheel	**32.240/ TS**		
Disk brake wheel	**32.240/ TS**		

Technical Specification Issue 1

approved and registered by:

Luftfahrt-Bundesamt
38020 Braunschweig
Bundesrepublik Deutschland

Braunschweig, 28.12.99 signed Erckmann

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0.1 Document History

All changes to this operating manual must be recorded in the table below.

New or amended sections are identified by a vertical black line in the margin. The revision number and the date are printed at the bottom left of the page.

Revision number	Section Page(s)	Revision date	Reference	Approval date	Publication date	Reference Signed
1		1.5.2002			May 02	Fenzl

0.2 Contents

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Caution
TOST aircraft wheels must only be used in accordance with the instructions and operating limits set out in this manual.
Once the wheel has been installed in the aircraft, this manual must be added to the aircraft operating manual.

1. General

1.1. Introduction

This operating instruction manual is intended to provide pilots, aircraft owners and workshop managers with the information needed for safe operation.
The manual includes all data that must be made available in connection with the technical specifications. It also lists additional information and recommendations that in the view of the manufacturer may prove useful.

1.2. Approval basis

This aircraft wheel has been approved by the German aviation authority (Luftfahrt-Bundesamt) on the basis of testing procedures for aircraft wheels and brakes dated 15.03.1956, alternatively TSO C26c requirements dated 28.12.1999.

1.3. Warnings, cautions, notes

There are three types of note in this manual and their importance for safe operation is defined as follows:

Warning
Ignoring an instruction of this type results in either immediate danger, or considerable risk, to flight safety.

Caution
Ignoring an instruction of this type leads to a minor or a more or less long-term reduction of flight safety.

Note
This heading draws attention to an item which is important or unusual, although it may not be directly related to safety.

2. Design

TOST aircraft wheels (except tail wheels) consist of two parts for easier assembly and are die-cast from a light-metal alloy. Special heat treatment increases the strength and improves the alternating flexural strength for optimal endurance.
The rim flange with integrated segment chambers serves as a crumple zone; in the event of overloading, load peaks are dissipated but the emergency rolling characteristics remain unaffected.
The coefficient of friction is improved by casting perlitic brake rings into shoe brake wheels.
The ball bearings with sealing rings are maintenance free, tension of the bearings is prevented through the use of spacer bushes.
Each wheel is embossed with the manufacturer logo and serial number, and also displays the specification and part number on a stick-on label.

3. Operating limits (cf. table on page 12)

4. Installation note

TOST aircraft wheels are all installed without axial tension. The hollow axle is simple pushed through the bore: it is impossible to put the bearings under strain by overtightening (see above).

Note
The spacer bush is visible through the bearing bore. When you replace a wheel, eg, after changing a tire, the bush should not be able to move axially. If it can move, this could mean that the inner tubing is being pinched or the wheel halves have not put been together correctly!

5. Operating notes

5.1. Landing wheels, valid for all wheels

For all two-part rims, the two wheel halves are connected with high-tensile DIN 912 M6 (10.9 or better) bolts.
Tighten bolts with a calibrated torque wrench: **9-10 Nm**.

Warning
Do not use bolts of lower strength!
Always use a torque wrench. The most frequent cause of bolt failure is tightening with too high a torque!

5.2. Shoe brake wheels

Shoe brake wheels are fitted with non-servo brakes: as the brake wrench turns, the primary shoe is pressed outwards in the direction of rotation of the shoe, the secondary shoe in the opposite direction. The clutching effect on the primary shoe increases the contact pressure and results in a significantly higher braking action than for the secondary shoe. This is the reason why the shoes wear differently.

Caution
The brake wheel is designed for normal operation. Do not use the brake wheel in your efforts to achieve a pin-point landing. It is better to keep your brake in top condition for when you really need it.

5.2.1 Brake shoes, brake drum and brake linings

Brake shoes are turned in pairs to the right diameter; never replace a single brake shoe (see above). Replacement shoes are colour-coded and must be fixed to the backing plate so that the mark is visible. New brake shoes must be run in, so make very careful use of the brake for the first 20 to 30 landings.
If brake linings glaze after prolonged or excessive use, the braking action is significantly reduced: clean scorched lining surface and brake drum with methylated spirits and emery paper.
Replace brake shoes when the lining is less than 1.5 mm thick at any point:

Warning
Continued use of a brake shoe with a worn lining can damage the wheel! You are strongly advised not to reline brake shoes.

5.2.2 Adjustable brake lever

When the brake lever is initially set or subsequently adjusted, the nut must be tightened with the stipulated torque:

M 8x1	DIN 936 =	18 to 22	Nm
M 6	DIN 934 =	6 to 8	Nm

Warning
If the nut is not tightened properly, the splined shaft could slip and damage the splines!

5.2.3 Brake cables

Ensure correct cable run: as short and direct as possible but avoid tight radii. Use a Bowden cable (recommended cable Ø: 2 to 3 mm) with adjusting screw for exact clearance adjustment. Readjust brake cable depending on wear.

5.3. Disk brake wheels

TOST disk brake wheels are a combination of the proven landing wheels and brake disks turned from heat-treated steel. The special heat treatment ensures that these wheels achieve very high braking deceleration, outstanding strength and minimal tendency to scoring.

Caution
Modern high-performance gliders are no longer equipped with skids: applying full brake capacity could cause the aircraft's nose to make ground contact and damage the underside of the aircraft.

We can supply TOG fixed-yoke disk brakes or a range of floating-yoke disk brakes from Cleveland.

Caution
Floating yoke disk brakes must move freely
in order to operate correctly:
check bolts regularly for corrosion and contamination.

The brake callipers are fastened to a torque plate and backing plate, or a combination of both (type-dependent).

For pressure transfer use either hydraulic fluid (MIL H 5606) or DOT 4 brake fluid (in TOG brake callipers and Cleveland callipers identified by Ø).

Caution
Use only the fluid approved for your aircraft's brake system!
DOT 4 brake fluid is strongly hygroscopic, ie, it absorbs water (this is the reason why old brake fluid has a corrosive effect). Replace fluid once a year according to the manufacturer's stipulations!

5.3.1 Brake disks

Check brake disks for fracture, excessive wear, grooves, corrosion and deformation.
Brake disks are given application-specific surface-treatment, so they will be subject to varying amounts of rust. Rust dust is removed from the disk by one or two parking brake operations. In the event of more serious rusting, it may be necessary to remove the disk from the wheel and to clean both brake surfaces properly. First clean the disk with a wire brush, then rub it off with sandpaper (220 grain). Finally polish with fine sandpaper (400 grain). This treatment may make it possible to continue using the brake disk.
Replace the brake disk if wear has progressed beyond the permissible limit. Measure the minimum at two or three places. Also replace the brake disk if the wobble is ≥ 0.2 mm.

Disk thickness	Wear limit	Application
3 mm	2.6	Synthetic disk brake wheels
4 mm	3.5	TOG brake calliper
5 mm	4.3	Cleveland calliper 30-9
6 mm	5.2	Cleveland calliper 30-63A
6.5 mm	5.5	Dual brake calliper 30-41B

5.3.2 Brake linings

Brake linings are made of asbestos-free, organic material. For top performance and long service life this material must be correctly conditioned:
Powered aircraft:
Roll aircraft at 1700 motor rpm over a distance of 500 m braked down to 10 to 20 km/h.
Allow brakes to cool for 10 to 15 min.
Work brakes and check whether the aircraft can be held with normal brake force when it has developed standing thrust at high motor rpm. If yes, the brake lining is conditioned (run in).
If the aircraft cannot be held against the standing thrust, repeat the procedure.

Gliders:
It takes 5 to 10 normally braked landings to condition the linings. If you need maximum brake performance from the start, brake the glider uniformly while towing it at 10 to 20 km/h for about 500 m (grass) or 200 to 300 m runway.

Wear limits:
The total thickness of brake linings at any point must not be less than 2.5 mm for Cleveland or less than 1.5 for TOG disk brakes.

5.3.3 Hydraulic hoses

Do not twist hydraulic hoses as this may weaken them. Twisted hydraulic hoses that are under pressure can work loose from their fittings.
When laying hydraulic hoses, allow for sufficiently large bends to prevent pinching of the hose. Pinching reduces the cross-sectional area and impairs braking performance.

The life expectancy of a hydraulic hose is reduced significantly by small hose radii. Use hoses made of steelflex, if you cannot avoid tight bends.

Caution
Hydraulic hoses laid horizontally should be inclined towards the rolling axis.

6. Service instructions

Adjust shoe brakes regularly to compensate for the shoe wear.
Clean wheels regularly to ensure that all parts can move freely and to inhibit corrosion.
At the same time, check wheels for corrosion, cracks and visible damage; also check the brake lining or disk for minimum thickness.
If you are flying in areas where airborne salt is a problem, there may be corrosion. The solution is to clean the brake wheel, sandblast it and cover the damaged areas with clear varnish.

7. Defects: causes and remedies

After a hard landing check wheel for damage. Replace the ball bearings if you notice ball-bearing noise.

Caution
Also check the axis: even 0.1 to 0.2 mm wobble can cause the brake to block and destroy the wheel.

Landing with a blocked wheel (eg, by activating the valve lever) damages the brake and can destroy the brake plate.

Disk brakes:

Problem	Possible cause	Remedy
Insufficient brake pressure or excessive travel	Air in system	Locate error, bleed air
	Leaky system	Locate and fix
	Defective master cylinder	Repair or replace
Brakes lock	Piston jammed in cylinder	Repair or replace
	Foreign object	Remove
	Water in hydraulic system	Evacuate and purge
	Piston does not return	Evacuate, remove piston and inspect for damage
	Rigid hoses inhibit free movement	Use flexible hoses
	Corroded brake plate bolts	Clean and grease or replace
	Bent, cracked brake plate	Replace
High wear of disk and lining	Locked brakes	See above
	Poor conditioning	See page 7
	Excessive rust, grooves or holes in brake disk	Clean or replace
	Incorrect linings or disk	Replace by original parts
Brake slips	Contaminated or scorched linings	Clean, see page 7 or replace
	Poor conditioning	See page 7
	Linings or disk less than minimum thickness	Replace, see page 7
	Insufficient brake pressure	See above
	New linings installed on used disk	Replace disk

8. Overhaul and check

An overhaul is not stipulated, annual check see Section 6 for capability test.

9. Tire removal and replacement

Warning
Tires under pressure can be dangerous if they are not handled carefully and with the correct equipment!

9.1 Removal

1. Jack up aircraft at specified point.
2. Deflate tire completely before removing the wheel unit.
3. **Do not unscrew the valve insert until the tire pressure has dropped to 0.2 bar.**
4. Remove wheel from axle.
5. Loosen wheel bead from the hub shoulder with a rubber or plastic hammer.
6. Undo wheel bolts (with 5 mm hexagon key), remove bolts and washers, split hub halves.

9.2 Replacement

1. Tires and wheel hubs must be clean and dry.
2. Do not apply excessive force when replacing a wheel.
3. Apply a dehesive agent (or talcum powder) to the hub shoulder.
4. Remove dirt, sand, labels, etc., from the tire. Apply a moderate amount of talcum powder to reduce friction between tube and tire. **Caution: Too much talcum has the opposite effect.**
5. Fill air into tube (tube placed in the tire) until it is evenly round. Remove nut and washer from valve.
6. Replace tire (red mark at valve hole) and tube on the wheel half with the valve hole, push valve through valve hole.
7. Push other wheel part onto tire, match bolt holes with centring shaft.
8. Insert wheel bolts, washers and any nuts, and tighten to the correct torque (M6: 9 to 10 Nm). Tighten bolts diagonally.

9. Place a tire in a safety cage, when inflating it to mounting pressure for the first time. If you do not have a safety cage, take great care when inflating the tire. Inflate the tire to mounting pressure. The mounting pressure is 10% more than the specified operating pressure. Check carefully for leaks. Leave to adjust at this pressure for 12 to 24 hours. Once the tire shows no leaks and is at operating pressure, the wheel unit can be mounted on the aircraft.
10. Make sure that the wheel unit is mounted perfectly balanced to avoid vibration and excessive wear.

Note special instructions when mounting tires on very narrow wheels.

9.3 Tire maintenance instructions

1. Maintain stipulated air pressure, check at regular intervals! Underpressure results in reduced load capacity and shortens service life.
2. Inspect tires at regular intervals for damage, shredding, flat areas and foreign objects.
3. Wheel units must be mounted perfectly balanced. Wheel imbalance can result in damage to bearings and brake drums.
4. Keep tires free of oil, grease, brake fluid and tar. Clean tires with rag soaked with petrol, then wash off with soap and water.

Caution

Note on used inner tubes:

Aircraft tubes are made of natural rubber and they are slightly underdimensioned making them easier to install in new tires. The layers of an aircraft tire are made of nylon and tend to stretch slightly with use. The inner tube also increases in size, adapting to the larger inside diameter of the tire. If a tube enlarged in this way is later fitted in a new tire, it may be too big for the tire, with the result that the tube may wrinkle. The wrinkles may rub through during operation, causing the tube to lose pressure. Rubbing through slowly results in gradual pressure loss – the pilot is thus warned before a dangerous situation arises. If the tube tears during a start, the pilot will fail to notice that he is flying with a flat tire. This can result in extremely hazardous landing situations.

In view of the considerable risks involved in fitting an old tube into a new tire, you are advised always to fit new inner tubes in new tires.

Betriebsgrenzen, Spezifikationen und zugeordnete Bereifungen (zu 3.)

Art	Größe	Techn. Spez.	Baureihe	LagerØ	stat. Last	dyn. Last	max. Last	Bruchlast		mögliche Bereifung	bei Breite
				[mm]				rechn.	getestet		[mm]
Laufrad	3"	32.240/1TS	2a	20	200		300			210x65	
			2b	20	200		400			200x50	
Laufrad	4"	32.240/2TS	2a	17	625	975	1540	2665		2.80/2.50-4	60
			2b	17v	760	1200	1900	3200		260x85, 3.00-4, 4.00-4	85 (zus.)
			2c	20/25	900	1400	2200	3800	6000	330x130, 355x150, 5.00-4	100 (zus.)
Laufrad	5"	32.240/3TS	4a	17v	760	1200	1900	3200		5.00-5, 380x150, 6.00-5, 350x135	
			4b	20/25	900	1300	1750	2600		5.00-5, 380x150, 6.00-5, 350x135	
			4c	20v/30/35	1240	1850	2500	3700	4800	5.00-5, 380x150, 6.00-5, 350x135	
Laufrad	6"	32.240/4TS	5a	30	1400	2200	3500	6000		6.00-6, 15x6.00-6, 7.00-6, 8.00-6	
			5b	35	1400	2200	3500	6000		6.00-6, 15x6.00-6, 7.00-6, 8.00-6	
			5c	40	1400	2200	3500	6000		6.00-6, 15x6.00-6, 7.00-6, 8.00-6	
TB-Rad	4"	32.240/5TS	2a	17	625	975	1540	2665		2.80/2.50-4, 260x85, 3.00-4, 4.00-4	
			2b	20/25	900	1400	2200	3800		260x85, 3.00-4, 4.00-4	103
										260x85, 3.00-4, 4.00-4, 355x150, 6.00-4	113
			2c	30	1300	2100	3300	5700		8.00-4	
TB-Rad	5"	32.240/6TS	4a	17v	760	1200	1900	3200		3.50-5, 5.00-5, 350x135, 380x150, 6.00-5	
			4b	20/25	900	1400	2200	2640		3.50-5, 5.00-5, 350x135, 380x150, 6.00-5	
			4c	30/35	1240	1850	2500	3700	4800	5.00-5, 350x135, 380x150, 6.00-5	
			2	30	1240	1850	2500	3700	4800	5.00-5, 380x150, 6.00-5	
TB-Rad	6"	32.240/7TS	4	30	1240	1850	2500	3700		6.00-6, 7.00-6, 8.00-6	
SB-Rad	4"	32.240/8TS	1a	20/25	900	1400	2200	3800	6000	260x85, 3.00-4, 4.00-4, 5.00-4	
			1b	20	900	1400	2200	3800	6000	260x85, 3.00-4, 4.00-4, 5.00-4	
SB-Rad	5"	32.240/9TS	4a	20/25	900	1300	1750	2600		5.00-5, 380x150, 6.00-5	
			4b	30/35	1240	1850	2500	3700	4800	5.00-5, 380x150, 6.00-5	
			4c	30v	1800	2700	3650	4800		5.00-5, 380x150, 6.00-5	
			4d	30/35	1240	1850	2500	3700	4800	5.00-5, 380x150, 6.00-5	
SB-Rad	6"	32.240/10TS	6	30/40/50	1400	2200	3500	6000		6.00-6, 15x6.00-6, 7.00-6, 8.00-6	
			5	30/40/50	1400	2200	3500	6000		6.00-6, 15x6.00-6, 7.00-6, 8.00-6	

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